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Value Management in Infrastructure Project Design: Unlocking the Project Team's Creativity

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Abstract: Value Management (VM) is a proven methodology that provides a structured framework using supporting tools and techniques that facilitate effective decision-making in many types of projects, thus achieving 'best value' for clients. It offers an exceptionally robust approach to exploring the need and function of projects to be aligned with client's objectives. The functional analysis and creativity phases of VM are crucial as it focused on utilising innovative thinking to understand the objectives of clients' projects and provide value-adding solutions at the early discovery stages of projects. There is however a perception of VM as just being another cost-cutting tool, which has overshadowed the fundamental benefits of the method, therefore negating both influence and wider use in the construction industry. This paper describes findings from a series of case studies conducted at project and corporate levels of a current public funded infrastructure projects in Malaysia. The study aims to investigate VM processes practised by the project client organisation and evaluate the effects of project team involvement in VM workshops during the design-stage of these projects. The focus of the study is on *how* issues related to 'upstream' infrastructure design aimed at improving 'downstream' construction process on-site, are being resolved through multi-disciplinary team consideration and decision-making.

Findings from the case studies indicate that the mix of disciplines of project team members at a design-stage of a VM workshop has minimal influence on improving construction processes. However, the degree of interaction, institutionalized thinking, cultural dimensions and visualization aids adopted, have a significant impact in maximizing creativity amongst project team members during VM workshop. The case studies conducted for this research have focused on infrastructure projects that utilise traditional VM workshop as client's chosen VM methodology to review and develop designs. Documents review and semi-structured interview with project teams are used as data collection techniques for the case study. The significant outcomes of this research are expected to offer alternative perspectives for construction professionals and clients to minimise the constraints and strengthen strategies for implementing VM on future projects.

Keywords : Value management, institutionalized thinking, design processes

1. INTRODUCTION
[1]

Ever since the birth of Value Analysis (VA) in 1940's, the concept of applying a structured decision making approach that adds value to the resultant outcomes has always been a core consideration of the Value Management (VM) practitioner. The transition from VA into VM has introduced a structured, systematic and analytical process, which seeks to achieve value for money by providing all the necessary project functions at the lowest total cost consistent with the required levels of quality and performance (AS/NZS 4183, 2007). It incorporates multi-disciplinary team effort (Kelly and Male, 1993) directed towards analysing the functions of projects for the purpose of improving, maintaining performance and ensuring value for money (Barton, 1991) while reducing or maintaining overall life cycle cost.

Both philosophy and style of management in VM as described by Male and Kelly (1989) are dedicated to motivate, develop skills and promoting synergies among team members in order to maximise the overall performance of an organisation. VM brings team members of an organisation closer towards fulfilling client's project objectives without them realizing the process taken. The depth of VM is over and above being just a cost cutting paradigm, it provide a soft system thinking approach to problem solving. The use of VM enables organisations to adopt a consistent approach towards decision-making, taking into account the needs of the business, the environment within which it is operating, and the people who may be involved(Yu *et al.*, 2005).

This perception of VM as merely a cost cutting exercise or "after the event cost cutter" among construction practitioners possibly stems from their past experience when participating in a VM study that ultimately only ends up in trimming the overall cost through variations made to the project. Furthermore, the institutionalised

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thinking of many of the participants in VM exercises may have an impact on types and quality of eventual outcomes. For instance, a Quantity Surveyor leading a VM study may have a focus and sensitivity directed mainly towards the costing aspects of the project but a lesser appreciation towards the aesthetics of the design. On the other hand, a Designer may lead the team more towards consideration of the aesthetics of the project rather than on the economical aspects. The dilemma arising from this thinking is not restricted to the leader alone, VM participants are also subject to injecting their perspectives and priorities thus affecting the direction of the VM outcome. So institutionalized thinking in VM operation influences how practitioners perceive appropriate value to be imposed on a project due to their own interpretation of the client's objectives. Although this has yet to be confirmed through further research, the perception of VM as a cost-cutting process does appear to exist. Whilst there is no right or wrong answer as to how any particular practitioner approaches VM, there is a need to draw a balance between the economic and other aspects of projects along the value continuum whilst disregarding members' potential discipline or institutional biases.

This research aim to investigate the application of VM studies undertaken during the design development stage of a project focused on discovering answers as to how issues related to construction process on-site are being resolved through multi-disciplinary team dynamics. The need for a more neutral consideration of value based on examining the design against the relevant practical processes needed to construct it, paramount for this research project. This research is based on a current airport development project in Malaysia that has applied VM during the project planning stage as a measure to increase value on the project.

2. LITERATURE REVIEW

2.1 Building Design Process

According to Cyan Research (2003), design is an iterative process through which a set of requirements such as – physical, aesthetic, performance, and so on – are creatively manipulated, resulting in a design. Design can be seen as a generic activity, and there appear to be real differences between the end products created by designer in various domains. The process is a complex interaction of skills, judgement, knowledge, information, and time (Mao *et al.*, 2007); aimed at satisfying the client's requirements by manipulating constraints such as statutory obligations, technical feasibility, environmental standards, site conditions and cost (Ferry *et al.*, 2003). It requires problem finding, and problem solving, deduction and the drawing of inferences, induction and the creation of new ideas, analysis and synthesis (Lawson, 2006).

Building design and construction are not abstract processes undertaken in individual isolation (McGeorge, 1988), they are both reliant on a collective approach to developing and managing information. The process comprises contributions from many specialists. The time taken to incorporate the information depends on the amount, its quality and importance to the generation of the total design. The rapid progress through both the design and construction phase of new buildings creates pressures for project management control, arguably beyond the capability of the individual building designers (Tunstall, 2007). This scenario requires a collaborative design effort in meeting clients' objectives for their projects. According to Lawson (2006), the designer can see from the drawing how the final design will look, but unfortunately, not necessarily how it will work. Best (1999) argued that it is not feasible to expect a single person to be able to address all aspects of the design and development process of integrating various forms of information and requirements.

The constraints that exist in the design process are entirely internal to the system or object being designed, or may be linked with some external factor not under designer's control. Lawson (2006) has identified four types of constraints faced by designers during the design process, which include:

i. Radical Constraint

Deals with the 'primary' purpose of the object or system being designed. For instance in the design of a hospital the radical constraints are those related to the health care system that the hospital is there to implement.

ii. Practical Constraint

Relates to the reality of producing, making or building from a design, in other words, the buildability issue imposed by the design. The challenge faced by the designer is to ensure that what has been designed can be constructed and will last for a certain life span and with a certain degree of durability.

iii. Formal Constraint

This is concerned with the overall visual organisation of the object being designed and regulates how the designer thinks and expresses an understanding of the client's requirement with regard to the end product of the building.

iv. Symbolic Constraint

This constraint shares almost similar attributes to those of formal constraint, the only difference lies in the expressive qualities of the design to achieve specific effects. Expressive qualities in the context of symbolic refer to the end product of the design which represents a mix of organisation, revolution, thinking or power.

These constraints present barriers to the designer in producing effective design solution. The competing needs that exist between the visual effect of design and the practical solution for construction of the project resulting from it in turn lead to a contribution from other parties in providing information or feedback to assist with the design process. The fragmentation of the design process has led to common scenarios of separation in the designer's role, and between the design and construction processes (Lovins and Browning, 1992). The traditional method of procurement has been criticised for its separation of the design and construction process, which has hindered communication, coordination and integration amongst the design and construction team (Lopez *et al.*, 2010). Lawson (2006) stressed that separating the responsibility for the design of these uncoordinated elements will inevitably lead to clashes during construction.

2.2 Expansive Learning in Design

With regard to the theory of expansive learning according to Engeström's (2002) as cited in Iordanova *et al. (2010)* "*...joint design activity is characterised by a community of multiple points of view, traditions and interests*". Understanding the design process and knowing what information is required for specific design activities is important in order to effectively utilize construction knowledge in design (Pulaski and Horman, 2005). According to Song *et al. (2009)*, information that can be articulated in written form, such as guidelines and rules, is referred to as *explicit knowledge* while knowledge that exists only in the experience of the experts e.g., (technical skills, intuitions, and insights) is referred to as *tacit knowledge.* According to Nonaka and Takeuchi (1995) as cited in Pulaski and Horman (2005), research in the field of knowledge management found that approximately 80 per cent of what individuals know is in the form of tacit knowledge.

Polanyi (1962) as cited in Lam (2000) argues that a large part of human knowledge is tacit and this is further confirmed by Hanlon and Sanvido as cited in Song *et al.* (2009) who states that 83 per cent of construction knowledge is not written down in any form, but lies in the experience of the experts themselves. Lam (2000) further stresses that the transfer of tacit knowledge requires close interaction and the building up of shared understanding and trust among project teams.

2.3 Value Management in Design

Projects can be designed and constructed in various different ways to satisfy client's requirement. The interpretation of client's requirement from one designer to another differs in the way that each designer perceives the end product in their own paradigm. Each different design attracts particular costs, which in turn satisfy the clients's requirement. In this case, how do we determine which design is more suitable than the other? Defining actual requirements of a project and eliminating unnecessary costs from the design requires a platform from which the design team and clients can structurally analyse issues and VM provides that platform. According to Green (1994), the structured process of dialogue and debate among designers and decision makers during an intense short-term conference will develop a common understanding of the design problem . It focuses to define actual problem and generates a range of possible solutions (Clackworthy, 2006).

Whilst the traditional view of VM focuses on reduction of unnecessary cost (Ashworth, 2004), identifying deficiencies, omissions or superfluous items (Leeuw, 2001), the application of VM ever since its introduction to the UK construction industry has experienced a paradigm shift from monetary focus towards strategic planning of design. VM includes important issues such as operational effectiveness, flexibility, comfort, site & architectural image, cultural values, engineering performance, environmental sustainability, and construction scheduling (Kirk and Garrett, 2004).

2.4 Value Management in Malaysia

Realizing the unprecedented benefits of VM, it was introduced into the Malaysian construction industry in 1986 within the private sector (Jaapar and Torrence, 2007). The application of VM transcends across various sectors in the Malaysian economy with majority being in the construction sector. However, the application has not been widely practised in Malaysia as observed by Jaapar et.al (2009). Despite the introduction of VM in the early 1980's, the momentum of its application was slow within both on private and public sectors. Minimal formal training and practice of VM methodology within working environment are observed factors which has contributed to slow acceptance within the industry (Jaapar et al. 2009). The level of awareness and appreciation of VM as an essential toolset for better value for construction projects during the 80's and 90's may have also been due to the lack of a formal body to govern and promote the application of VM rigorously in the Malaysian market. Through government encouragement, the Institute of Value Management Malaysia (IVMM) was established in 2000 with the aim to promote VM within the Malaysian economic sector and create awareness of its potential benefits among construction industry professionals in particular. After nine years of concerted effort to establish VM within the Malaysian sector, the government through its Economic Planning Unit (EPU) introduced a "Value Management Guideline Circular 3/2009" to be applied to the public sector projects and programme. This circular makes it mandatory for all Government contracts exceeding RM50 million of budgeted cost to apply VM as a measure to increase value for such contracts (Economic Planning Unit Malaysia, 2009). This mandatory requirement for VM to be utilized by the construction industry set a new benchmark for other Malaysian industry sectors to follow after numerous successful VM studies were conducted demonstrating value added potentials in construction projects.

3. RESEARCH METHODOLOGY

This research uses case study methodology to explore the application of VM on infrastructure projects. Case study research applies experimental theory to examine the topic of interest using set of procedures and comprises several different combinations of data collection such as interviews, surveys and documentary evidence, the emphasis being on investigating a phenomenon within a context (Fellows and Liu, 2008) cited in (Knight and Ruddock, 2008). Investigating the phenomenon of VM as a means to reviewing design is the main context of this study and so the case study approach is used to investigate in depth actual infrastructure projects.

Multiple Case Studies

The aim of using case study methodology is to expand the proposition of VM as a structured approach to decision making and enhancement of multidisciplinary team effort, and as being highly beneficial for use in construction projects. In selecting the number of cases for the study, Herriott and Firestone (1983) in Yin (2009) assert that multiple case study is more compelling and the overall study is regarded as being more robust as compared to a single case study. Therefore, this study adopted a multiple case study methodology as means to collect data for the study.

Selecting a case

The Malaysian construction sector is selected as focus of this research and selection of cases. Based on the research questions, objectives, propositions and literature reviewed, the following criteria have been selected for the case study selection.

1. Completed projects with VM study

Use of completed projects for VM studies not only produces a report on the outcomes, and on the next course of action, but also on the lessons learned from the process. This criterion is necessary to ensure full documentary evidence to support and guide the research process.

2. Building or Civil engineering works projects

The scale of expected projects ranges from medium to large construction that also fulfills the first criteria set above. Additionally, the "VM Circular 3/2009" which mandated that projects exceeding RM50million had to implement VM study sets the scale of projects on which this research was based.

3. VM focus on design development stage

This criterion refers to the focus of projects with VM studies being based on a supposition that design is the main factor of inquiry. The design factor is an important focus for this research as the study is looking at the interaction of multi-disciplinary teams in design development stage of a project.

4. Multidisciplinary team composition

An accurate selection and representation of multi-disciplinary team members in the study is essential in achieving the objectives of this research and to ensure that a balanced view across all professions is obtained.

5. Organisation with Standard VM Procedures

Possession and use of standard VM operating procedures and documentation are important to ensure a structured and consistent workflow is achieved across VM studies across organisation.

Data Collection and Analysis

Document Review

Documentation is required in order to identify past decisions made, information on project details, participants involved and to corroborate evidence. Documents reviewed for this research are as follows:

i. Drawings
ii. VM Reports
iii. Site Reports & Minutes of meetings
iv. Administrative documents
v. Policies

Interviews

A semi-structured interview was used in this research with selected projects understudy. Interviewees were drawn from project consultants involved with the selected projects. VM reports is used to identify participants list and their backgrounds. The semi-structured interview was designed to focus on:

a. Discussion of value management studies focussing on design development of particular projects, specifically on how each consultant views problems of the design and the creative process in problem solving.

b. Discussion on multi-disciplinary team involvement and attributes that either promote creativity, dynamic and resistance in the interaction between participants.

Nvivo qualitative data analysis software (QSR International Pty Ltd, Version 9, 2010) was used in this research to manage all qualitative data and to assist with coding, theme-building and interpretation from the data set. Content analysis was used to analyse written and verbal communications and messages from the data set (Cole 1988) as cited in Elo and Kyngas (2008). It is a method for making replicable and valid inferences from data with regard to their context, with the purpose of providing knowledge, new insights, a representation of facts and a practical guide to action (Krippendorff 1980) as cited in Afila and Smith (2007).

4. THE INTERVIEWEES

The researcher has identified two major organisations which fulfill all of the requirements for this research. Both organisation are from public and private sector that oversee construction projects of a large scale and of national interest. A proposal and invitation were sent to both organisations, in which the private sector (referred hereafter as Organisation A) organisation responded and approved access to their projects. Organisation A has been running value management studies for almost half a decade on all of their projects and has followed the public sector practice in producing their own value management manual. Access to an on-going international airport construction project (which comprises of 20 work packages) was given to the researcher. Out of twenty, six project packages were selected to form cases which include the main terminal building development package. From the six cases, lists of VM participants were obtained from VM reports. 25 project consultants and stakeholders consented to be interviewed (Refer Table 1). Due to the on-going nature of this project, methods of interviewing varied according to interviewee's availability and suitability. Interviews were conducted using face to face, phone, emails, FaceTime and Skype.

Group	Professional Background	Total
A	Facilitator	3
B	Architect	2
C	Quantity Surveyor	2
D	VM Executive	4
E	Commercial	1
F	Procurement	1
G	Interior Design	1
H	Structural Engineer	1
J	Specialist Consultant (Facilities Management)	2
K	Civil Engineer	2

L	Client	2
M	Project Management Consultant (PMC)	1
N	Airport Management Team	3
	Total	**25**

Table 1 - Interviewees professional backgrounds

5. FINDINGS FROM DATA COLLECTION

The analysed documents for this research has generated key information which form a basis to structure interview questions and guide the case study process. The following are attributes derived from the documents analysis:

- Project details information
- Visual documents used for the study (i.e. drawings, PowerPoint presentation, sketches etc)
- The objectives of the workshop
- Workshop agenda
- Workshop participants list and details
- The value of project packages understudy
- Savings generated from the workshop
- The boundary set for the study
- Cost plan
- Function analysis process
- List of generated ideas
- VM recommendation
- Action plan
- Approving authority for all recommendation
- Procurement system and procedures

Attributes listed above are used to provide insight and create a foundation to understand the whole scenario of VM as practiced by Organisation A. It is observed that the methodology applied and approach taken in the VM process is similar to existing literature and practiced on VM workshop. The management during pre and post workshop phase, the Job Plan, tools and techniques as well as facilitation style are reflective of what has been practiced outside. The flow of each five phases Job Plan are clearly reported in the report with key findings at the end of each phase. 'Brainstorming' technique has been used as main driver to stimulate creativity among participants while Function Analysis is use to investigate core issues in the design of the project.

However, the completeness of information and level of details which support the decision making in this workshop is observed to be limited in nature. Additionally, recommendation made in the VM report although is supported with calculation and function analysis, their justification and significance of the decision made were not clearly stated. This has prompted the researcher to seek further elaboration through interviews.

The interview session with each interviewee ran between 1.5 to 2 hours and consists of 10 main questions with 2 follow-ups and 2 probing questions. All interviewees responded anonymously with their details only being captured by the researcher. The interviews have generated a very large amount of qualitative data (70,000 words; 200 pages of interview transcripts). According to Ellis et.al (2005), "*the automation of coding activities provides essential support for conclusion drawing and verification*". Each interview transcript was coded in two stages, first by the researcher and some supporting colleagues each coding the same sample transcripts to make sure everyone understood the same meaning and context of the transcripts. In the second stage, transcripts were re-coded in order to resolve variance between codes generated in the first stage.

The analysis of the data has generated 11 major themes as indicated in Table 2.

Theme Ref.	Themes
Theme 1	Team representation
Theme 2	Institutionalized thinking
Theme 3	Culture
Theme 4	Visual aid
Theme 5	Facilitation techniques
Theme 6	Tacit knowledge
Theme 7	Team dynamics
Theme 8	Explicit knowledge
Theme 9	Availability of information
Theme 10	Control mechanism
Theme 11	Tools & techniques

Table 2 - Generated themes from qualitative analysis

For the purpose of this paper, four major themes and their findings were selected for further discussion.

5.1 Team representation

96 percent of respondents expressed the view that multi-disciplinary representation is important in the creative process of problem solving in design. The knowledge, skills and experience of each particular member provided a different source of contribution to the VM study. A majority of the respondent believes in the dynamic of creative problem solving through multiple perspectives based on their past experiences as participants. The inclusion of participants beyond the construction team is highly recommended to provide them with understanding of the project development and improve communication and build relationships.

"A representative from the Legal Unit should attend the workshop as well to be able to understand the language and the process involve in the construction process. After all, if any disputes pop up from the project, they are the ones that we will be communicating with."

However, having sufficient representation alone does not guarantee the effectiveness of the creative process in value management. One respondent believed that multi-disciplinary representation is not crucial if the main objective of the study is inclined to one particular area of expertise i.e. IT systems. This respondent felt that there is no point calling other consultants to be involved if the subject matter is beyond their knowledge and expertise, but rather constrain participation to those with specific knowledge and experience of the focus subject matter. The respondent's past experience of having difficulty following the workshop flow of one particular package that is not within his expertise has left him with this impression. Although this was a minority view, the extension of this notion clearly indicates the importance of having the right person involved in workshops with the correct level of

knowledge/expertise, rather than having participants with unrelated or too broad expertise.

The study also found that, there is a difference between team representation (pre and post construction) used in VM studies. The pre-construction team consists of all consultants and stakeholders from the Client headquarters office while the construction team on-site is also from the same Organisation A but are different personnel due to working at the actual site office. However, representatives from the Client headquarters office are involved in all VM studies from the project planning stage up to construction providing that they actually hold some authority to make decisions. A variance in opinions exists regarding the numbers of consultants and specialist required for a VM study ; most respondents believed that they held specific expertise to advise the team on issues concerning the design. 60 percent of the respondents feel that consultant staff that work on site should be invited to participate in VM study at the beginning of the project. They are regarded as being those who deal on a daily basis with the construction process and are therefore in good position to contribute. Furthermore, 40 percent of respondents feel that contractors' involvement is essential in a VM study. One example given during the interviews was regarding a recommendation made from the VM study to reduce the size of a specific runway design:

".....we have to revert to original design after consultants on-site found that the design is slightly below safety standards. I have an impression that why don't you (consultant on-site) be involve in the VM study at the first place, we should have identified it earlier on…"

It is not always possible to have on-site consultant staff involved during the early stage of a value management study, their role against the type of procurement selected for the project may have a major influence in permitting their involvement. Nevertheless, if the consultants are from the same organisation, consideration with their involvement at the early stage is crucial for this project.

Organisation A has carefully appointed credible consultants and specialists to work on this project, however, as part of the facilitation team, external specialists were also invited to attend the workshop to provide a so called "*challenge factor*" to the existing team. One respondent from the facilitation group expressed support for this idea:

"*…I have invited external specialist to join me in the VM workshop with aim to challenge the recommendation made by existing consultants as I believe that external perspective are important in striking the balance in creativity. Internal consultants can be too immerse with their own thought of this project. Having the external specialist just makes the discussion more dynamic and It is the facilitation team effort and it works"*

5.2 Institutionalized thinking

In relation to the above finding where external consultants were invited to create 'challenge factor' dynamics during creativity process, 76 percent of the respondents indicated that they were solving design issues based on their own interpretation of those issues. Such interpretation of issues stems from consultants own discipline background which the researcher has termed as 'institutionalized thinking', a concept inspired from the work of Green and Liu (2007). According to these authors (2007), "*there is no universally accepted codification that extends across institutional networks in VM, where it cannot be understood in isolation from institutionalized networks.*" Respondents were asked the kind of solutions they would provide for one particular design during the creative process and the majority cited solutions which had affiliation to their institutionalized perspectives. For instance, an Architect generally expresses ideas through design solutions, aesthetic value and user-friendly designs, while the Engineers will focus more on safety measures with less emphasis on the aesthetic value. 28 percent of the respondents feel that the facilitator's own professional background has indirectly impacted their perception of the need for utilising value management. In this case study, the majority of the project packages were facilitated by someone with a Quantity Surveying background. The stereotype thinking that links QS involvement with a cost cutting approach prevailed in the perception of 28 percent of the repondents. Although an investigation of the relevant VM reports of one particular case study clearly indicated a focus on some minor cost saving, this was overshadowed by the major design improvements that resulted. The question of faciliation methods and how a workshop is conducted has proven amongst many of the cases in this research to support that streorotypical thinking still exists amongst many practioners.

There is nothing wrong with the institutionalized thinking which exists among workshop participants of the case study. The requirement for a multi-disciplinary representation for the workshop has directly influenced the situation. However, persuading practitioners to move away from the boundaries of institutionalised thinking would require the creation of a very new thinking paradigm in the Malaysian context and one respondent stated:

I observed participants giving suggestions based on their own intuition and insights rather that based on hard technical knowledge.

Such views although only expressed by relatively few respondents demonstrated the importance of tacit knowledge of the participants and expansive learning emanating from the creative process in value management workshop . Moving away from institutionalized thinking helps to stimulate participants to think critically about their ultimate decisions relating to future outcomes (Green, 1997).

5.4 Visual aids

The rooms for the VM workshop conducted by Organisation A was fully equipped with state of the art technologies which greatly assisted the running of a workshop. However, despite this environment, limitations still existed amongst participants in terms of making full sense of the recommended ideas and presentations of the design issues by the consultants. 92 percent of the respondents are of the opinion that the Information Stage of the workshop is important to capture, disseminate and bring to a same

common level of full understanding of the design. However, a quarter of that 92 percent of respondents thought that not all projects were carefully presented in details in which some information were too abstract in nature or rather too technical. The researcher observed that this is not the case entirely as difficulty in understanding the design should not rest on the shoulder of the presenter alone. Its should be a two way of communication instead. But one respondent which represented the Client has cited an example of a solid case which involve a design of a lounge area in the main terminal building.

In this project package, VM study were conducted to reduce some space in the waiting lounge to substitute for another space. Sketches were used to reflect the ideas agreed by the participant after brainstorming. However, when it come to construction phase, the team realize that the lounge area were no longer comfortable and ergonomical as a result of space reduction which didn't take into account users comfort, ergonomics of design and proper visualization. Personally, it is obvious that I have misinterpret the sketch knowing it will serve the final output properly.

The example given indicates the importance of visualization aid used during value management workshop especially is assisting towards ideas creations. Based on document review, all VM reports were supported with visual documentation in power point presentation format which have been scaled down to fit the report. The representation of key information and effected design understudy in the drawings is observed to have limited visibility for a decision maker to take a second look at the recommendation made. Should the information and drawing presented were misleading and failed to capture participants' understanding, it could lead the team into thinking for solution that may not works. Lawson (2006) has observed that designers faced with *formal constraints* which deal with visual organisation of the object behind are subjected to proof on their own perspective against the others. Difficulty in understanding the design matters of the workshop can be minimise through various ways as some respondent suggested use of Building Information Modelling (BIM) or Auto Desk to assist participant to visualise their ideas and access the feasibility of their recommendation. While some respondent suggested that drawings associated with the workshop should be disributed in weeks in advance to allow time to capture all information.

Nevertheless, distribution of information about the workshop in advance are widely practiced around the world in value management, in fact the same has been applied in this case. In addition, the application of BIM as visualization aid is rather interesting to capture and expanded into further research under this study for creative process as majority of literature focusses on tools, techniques and team dynamics but minimal on visualisation aid to promote thinking.

5.4 Cultural Dimension

According to Parker (1998), a desire to conform to proper patterns, customs or methods are categorized as "Cultural Blocks" in creative process of value management. Confirming the findings of the literature review, the interviews also captured the same elements from participants of the workshop. Twenty percent of the respondent feels that their ability to contribute ideas in the workshop is limited due to the cultural blocks that exist in their mind. Respondents were probed with further question in identifying what they perceive as cultural block to creative process in the workshop. They believe that although the workshop necessitates dynamics among participants, there was reluctance from participants to fully engage in the discussion. This is due to a perception of needing to adhere to certain levels of authority that they represented.

I accompanied my boss to this workshop and I had one recommendation which I thought suitable to address the design problem. Out of respect to my boss, I kept quiet as he didn't speak out on the issue during the workshop. After exhausting all ideas, one senior participant recommended the ideas which I had in mind and all participants accepted the recommendation.

The scenario described above is not imposed by the workshop, but instead was a self-imposed restriction and arose out of adherence to a cultural protocol. Such cultural barriers indirectly hamper the creative process in value management workshops, which are built upon open a communication concept and a learning paradigm. The researcher observed that there are two factors which contribute significantly to the self-imposed cultural blocks on participants, these are (a) age, and (b) level/position in the organisation. In relation to age factor, one respondent remarked that:

To my surprise one of the good ideas came from a person not affiliated to any particular professional background, and also he is a junior executive

The age factor generally affects participant at the junior staff level who are still new to the construction industry but the same is observed where the younger participants hold a subordinate position in which respect to a higher superior should be adhered to. In reverse, the elder respondents with higher seniority did not face any issues with the cultural blocks faced by those younger respondents. Instead they are having problem dealing with dominant participants who tend to try and force others to agree with their positions and refuse to accept the views of others. However, they direct their comments to the less experienced participants in order to be able to convince them (and others) to accept their suggestions.

We respect the aspiration of the junior staff in this workshop but we need credible people on board as the project is of national interest. If they could come forward and justify their ideas convincingly and using supported facts, then we don't see why their ideas can't be accepted.

CONCLUSIONS

The findings from this research have identified 11 themes generated from the qualitative analysis from six project packages on an international airport development project in Malaysia. These themes emanated from a series of interviews and documents analysis looking at how issues related to construction processes on-

site are being resolved through multi-disciplinary team involvement in the creative process. Four major themes has been discussed which reflected on key issues which could help to improve the dynamics of the Creative Phase of value management workshops.

The principal conclusion that can be made from this research is that the creative process of VM, in particular when considering project designs, took more than only the relative team dynamics to unlock the full potential creativity of the VM method. If the innovation and critical thinking available in the process, is to be fully and beneficially realized, a few factors need to critically exist in the system and these are:

- The *'challenge factor'* should exist within VM workshop quorum in unlocking creativity among participants. Regardless of whether the participants are internal or external to the project organization, neutral participants with sufficient level of knowledge could assist in transferring tacit knowledge which requires close interaction among participants.
- Moving away from the traditional 'brainstorming' technique to stimulate thinking may offer another perspective in minimising lack of contribution from participants and most importantly break the culture barrier through open communication. Techniques such as 'Gordon Technique", "Synetics Technique" and "Morphological Analysis Technique" are some of alternatives which could be used to unlock creativity among participants (Parker,1998).
- Having the right quorum of participants to attend the workshop, not just for multi-disciplinary representation, but to capture the views of stakeholders who are going to be involved directly with the project. The sense of ownership and pride for the project and achieving best value outcomes should exist in the quorum.
- Minimize institutionalized thinking system instead moving towards a more neutral (less biased) way of looking at things. Findings from Nonaka and Takeuchi (1995) as cited in Pulaski and Horman (2005), found that approximately 80 per cent of what individuals know is in the form of tacit knowledge. While this knowledge is not always associated with any institutional networks, the tendency to innovate from this form of knowledge is highly possible.
- Visualization is crucial in transferring information (especially with regard to designs) and making sure that workshop participants are well informed. The correct use of visual aids increases the chance of stimulating better ideas in the creative process of VM.
- Understanding and accepting the existence of cultural blocks in organizations and being aware of such barriers, working to remove or mitigate bias caused by them. Knowing how to put forward ideas convincingly and accept others views and valuable input thus offering greater opportunities to unlock the creativity present in the VM workshop.

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References

AS/NZS 4183:2007 *Value Management* [electronic resource] via Standards Australia Online. http://www.standards.org.au (accessed November 20, 2009)

Ashworth, A. 2004. *Cost studies of buildings*. 4 ed. Edinburgh: Pearson Education Limited.

Barton, R. T. 1991. Value management. A vehicle for innovation in building design and construction. Published and Presented in the, at Brisbane, Australia.

Best, R. 1999. Integrated design. In *Building in value*, ed. R. Best and G. d. Valence. London: Arnold.

Clackworthy, S. 2006. Value management. *Financial Management* (14719185):36-36. http://gateway.library.qut.edu.au/login?url=http://search.proquest.com/docview/195688380?accountid=13380 (accessed February 7 2012).

Cyon Research. 2003. Architectural automation : Facing the challenges of work-culture. In *Cyon Research White Paper*. Bethesda: Cyon Research Corporation.

Ellis, R., G. Wood and D. Keel. 2005. Value management practices of leading UK cost consultants. *Construction Management & Economics* 23 (5):483-493.

Economic Planning Unit Malaysia. 2009. Garis Panduan Perlaksanaan Pengurusan Nilai (Value Management), edited by P. M. Department.

Fellows, R. and A. Liu. 2008. *Research methods for construction*. 3 ed. Oxford: Wiley-Blackwell.

Ferry, D. J., P. S. Brandon and J. D. Ferry. 2003. *Cost planning of buildings*. 7th ed. Oxford: Blackwell Publishing.

Green, S. D. 1994. Beyond value engineering : SMART value management for building projects. *International Journal of Project Management* 12 (1):49-56.

Green, S. D. 1997. A participative research strategy for propagating Soft methodologies in value management practice. *International Journal of Project Management* 17:329-320.

Green, S. D. and A. Liu. 2007. Theory and practice in value management: a reply to Ellis et al. (2005). *Construction Management & Economics* 25 (649-659).

Iordanova, I., D. Forgues, M. Jemtrud, L. M. Farah and T. Tidafi. 2010. Interdisciplinary team learning in the context of integrated design studio. In *Construction Research Congress 2010*. Canada.

Jaapar, A., and Torrance, J. V. 2007. *Prototype Value Management: Guidelines for the Malaysian Construction Industry.* In Quantity Surveying International Conference 2007- Kuala Lumpur, Malaysia.

Jaapar, A., Endut, I.R., Bari, N.A.A. and Takim, R. 2009. The impact of value management implementation in Malaysia. *Journal of Sustainable Development* 2 (2).

Kelly, J. and S. Male. 1993. *Value management in design and construction : The economic management of projects*: Taylor & Francis.

Kirk, S. J. and S. E. Garrett. 2004. Innovative application of the value methodology (VM) for large, complex facilities. http://kirkvalueplanners.com/images/VMLargeComplexStructure.pdf (accessed April 1, 2010).

Knight, A. and L. Ruddock eds. 2008. *Advanced research methods in the built environment*. 1 ed: Wiley-Blackwell.

Lam, A. 2000. Tacit knowledge, organisational learning and societal institutions: An integrated framework. *Organization Studies* 21 (3).

Lawson, B. 2006. *How designers think*. 4 ed. Oxford: Architectural Press.

Leeuw, C. P. d. 2001. Value management: An optimum solution. In *International Conference on Spatial Information for Sustainable Development*. Nairobi,Kenya.

Lopez, R., P. E. D. Love, D. J. Edwards and P. R. Davis. 2010. Design error classification , causation and prevention in construction engineering. *Journal of Performance of Constructed Facilities*.

Lovins, A. and W. Browning. 1992. Green architecture: vaulting the barriers. *Architectural Record* (December).

Male, S. and J. Kelly. 1989. Organisational responses of public sector clients in Canada to the implementation of value management: lessons from the UK construction industry. *Construction Management & Economics* 7 (3):203-216.

Mao, W., Y. Zhu and A. Irtishad. 2007. Applying metadata models to unstructured content of construction documents: A view-based approach. *Automation in Construction* 16:242-52.

McGeorge, J. F. 1988. Design Productivity : a quality problem. *Journal of Management in Engineering* 4 (4).

McNamara, C. 1999. General guidelines for conducting interviews. http://www.mapnp.org/library/evaluatn/intrview.htm (accessed October 2, 2010).

Nonaka, I. and H. Takeuchi. 1995. *The knowledge creating company*. New York: Oxford University Press.

Parker, D. E. 1998. *Value engineering theory*. Washington Parker.

Pulaski, M. H. and M. J. Horman. 2005. Organizing Constructability Knowledge for Design. *Journal of Construction Engineering and Management* 131 (8):911-919.

Song, L., Y. Mohamed and S. M. A. Rizk. 2009. Early contractor involvement in design and its impact on construction schedule performance. *Journal of Management in Engineering* 25 (1):12-20.

Tunstall, G. 2007. *Managing the building design process*. UK: Butterworth-Heinemann.

Yin, R. K. 2009. *Case study research: Design and methods*. 4 ed. Vol. 5, *Applied Social Research Methods Series*: SAGE.

Yu, A. T. W., Q. Shen, J. Kelly and K. Hunter. 2005. Application of value management in project briefing. *Facilities* 23 (7/8):330-42.